The art of medicine

Beyond Bazalgette: 150 years of sanitation

In 1871, the Prince of Wales fell ill with typhoid fever while staying at Londesborough Lodge, near Scarborough, UK. Over the next 2 months his illness, and the sanitary arrangements at Londesborough and Sandringham, became the subject of intense public scrutiny. According to *The Lancet*, Londesborough was most likely at fault, being in effect "placed at the summit of a great length of sewer", with drains so inadequate that a "faint and deadly influence might have pervaded the whole house, or burst out of the closet" used by the Prince himself. In the following decades, sanitary reform—including clean water, drainage, and sewerage—became a local and national priority in the UK. Growing public interest in domestic sanitary arrangements, along with the rise of medical experts in local government, river pollution lawsuits, the extension of the franchise, and a new sense of civic pride, all helped to generate the political will necessary for an unprecedented level of investment in sanitation by local government. This investment, which peaked in 1890–1900, contributed to a dramatic decline in infant mortality.

2015 marks the 150th anniversary of London's sewerage system and the pioneering work of engineer Joseph Bazalgette (1819–91) who designed the city's sewers, celebrated this month in WaterAid's Big History Project. This investment in sanitation helped transform the nation's public health in the years that followed. Yet today 2.36 billion people still live without basic sanitation and nearly 1 billion defecate in the open. The resulting diarrhoeal disease kills more than 500 000 children every year—9% of all deaths in children younger than 5 years. Up to 50% of malnutrition is attributable to poor water, sanitation, and hygiene, as are many neglected tropical diseases. This year presents an opportunity to tackle these inequalities, as the global community defines a new set of Sustainable Development Goals (SDGs) to drive economic and social development until 2030. Current SDG proposals include a goal to make sustainably managed sanitation and water available for all. In 19th-century Britain and 20th century east Asian advances in sanitation played a key part in nations' development and transformations in health, productivity, and civic pride.

In the UK, histories of early sanitary reform often emphasise the importance of communicable diseases, such as cholera, and the work of social investigators. In east London in 1831, William Lovett found "great ravages" from fever: "unpaved yards, and filthy courts, and the want of drainage and cleansing rendered their houses hotbeds of disease". *Edwin Chadwick's 1842 Report on the Sanitary Condition of the Labouring Population of Great Britain* highlighted discrepancies in average life expectancy across the country: while a labourer in rural Rutland might expect to live until 38 years, the average life expectancy of a labourer in Liverpool was just 15 years. In the public consciousness, no disease was feared more than cholera. As *The Lancet* observed in 1831: "No rank escapes its attack...under its influence whole families are exterminated—civilised nations changed to savage hordes". The social and economic impact of outbreaks have lately been seen in West Africa, with riots reported in slums and economic activity depressed.

Early sanitary reformers helped create interest in the causes of poverty and disease, as well as awareness of the need for new legislation. The UK's 1848 Public Health Act was a legal landmark, making public health a government responsibility and empowering local authorities to borrow long-term loans, levy taxes, and purchase land to initiate drainage, sewerage, and water supply projects. But it also proved inadequate, with central government unable to compel localities into action unless their annual mortality rate exceeded 23 deaths per 1000 population. The 1848 Act

did not even apply in London, which established the Metropolitan Commissioners of Sewers and pushed through its own City Sewers Act. This encouraged greater use of existing drains, which fed directly into the increasingly polluted Thames. Finally, a hot summer in 1858 caused the foetid Thames to give off such a stench that the Houses of Parliament were vacated, and Members of Parliament spurred into action. 7 years after the so-called Great Stink, in 1865, Bazalgette's sewers were opened. Much of his sewerage system is still in use. Outside of London, many towns and cities took only tentative steps towards sanitary reform, prioritising new mains water supply pipes over more costly sewerage systems to avoid upsetting local taxpayers. In some places, such as Leamington Spa, landowners affected by defective drainage sued local councils to force them into action. Even when local authorities were convinced of the need for reform, they could be crippled by indecision.

Legislation required frequent revisions in the 1850s and 1860s to make reform easier and more attractive for local authorities. These revisions culminated in the 1872 and 1875 Public Health Acts, which placed responsibility for water, sewerage, and drainage firmly in the hands of local government, and compelled localities to appoint Medical Officers of Health (MOH). In 1873, central government reports show that 223 MOHs had been appointed, by 1878 there were 1138 and by 1900 more than 1600. These medical and sanitary professionals took up the cause of sanitary reform, becoming an increasingly vocal group. Philip Boobbyer, MOH for Nottingham, for example, showed and publicised links between typhoid and conservancy systems of sewage disposal.

The 1870s marked the start of increasing investment in sanitary reform, linked to growth in local government functions and the extension of the right to vote. Before the late 1860s, businessmen and small householders—who were little inclined to increased public spending—dominated local councils. Reform acts in the 1860s doubled the electorate by including all householders. The Third Reform Act of 1884 effectively quadrupled it, bringing in working men whose views were increasingly of concern to local politicians. In Manchester, reformer Charles Rowley organised a group of working men in the slum of Ancoats under the campaign "Healthy lives, healthy homes, and healthy surroundings", with thousands of people attending Rowley's Healthy Homes Society meetings including working men and city councillors.

All these developments created a context in which massive investment in sanitation was possible. Some areas, such as Birmingham under Joseph Chamberlain, drew on a new sense of civic pride to argue that municipal ownership of public goods would allow the city to amass financial resources for large-scale improvements. But what was striking was the extensive national uptake of central government loans, with low long-term interest rates. Although these had been available since 1848, the political will only caught up in the 1870s. In the 1850s and 1860s, the average value of loans for public health purposes was £300 000–700 000 a year; in the 1870s and 1880s it was more than £2 million; in 1890 it was £2.8 million, and in 1893 it had reached £7·3 million. This represented local government spending on an unprecedented scale: in total, more than £84 million was borrowed for public health works in this period.

Although 21st-century low-income countries are very different from 19th-century Britain, the public health landscape bears comparison. Urbanisation is still a defining demographic characteristic of these countries; expanding cities in low-income countries drive economic growth, but often at the cost of public health. The urban penalty is still a real phenomenon, with under-5 mortality rates in urban slums often worse than poor rural areas. During the 1950s and 1960s,

these characteristics were also prevalent in South Korea, Singapore, and Malaysia. Sanitary reform in these countries was even more rapid than in the UK, but involved a similar mix of political leadership, large and cross-departmental government spending on public health, and constant monitoring and revision of law and policy to improve sanitation progress.

From the late 1960s onwards, South Korean President Park Chung-Hee slogan Let's Try to Live Well, Singapore Prime Minister Lee Kwan Yew's campaign to Keep Singapore Clean, and Malaysia's New Spirit project of rural development all articulated national programmes geared towards public health and hygiene as the crux of a development agenda and a unifying national vision of progress. These programmes resonate with the current Indian Government's Clean India Campaign. Success in the so-called Asian Tiger states came from integrating sanitation spending with health programmes and improvements in housing - abolishing slum living in cities in South Korea and Singapore, and with rural health and building programmes in South Korea and Malaysia. In all cases, large amounts of public finance were devoted to improving sanitation as a matter of priority, beginning even before the acceleration of economic development. High level attention to real-time monitoring information helped transform high-level political will into momentum for change at local government level, as well as informing frequent policy refinements to accelerate progress.

These transformations in sanitation are rarely celebrated, and sanitation today is largely overlooked in the global health conversation. In the UK, less than 2% of overseas aid is devoted to sanitation. As countries in west Africa begin to recover from the recent Ebola outbreak, the global community is asking how health systems can be strengthened; the crucial role in public health of sanitation and hygiene should be part of this debate. Current attitudes are a far cry from 1897, when the journal *Public Health* reflected that "of all the achievements of the Victorian Era…history will find none worthier...than the efforts made to ameliorate the lives of the poor, to curb the ravages of disease, and to secure for all pure air, food, and water, all of which are connoted by the term 'sanitation.'"

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